

# DOE Type A Accident Investigation

---

Drilling Rig Operator Injury at  
Fermi National Accelerator Laboratory  
June 21, 2001

# The Accident

---

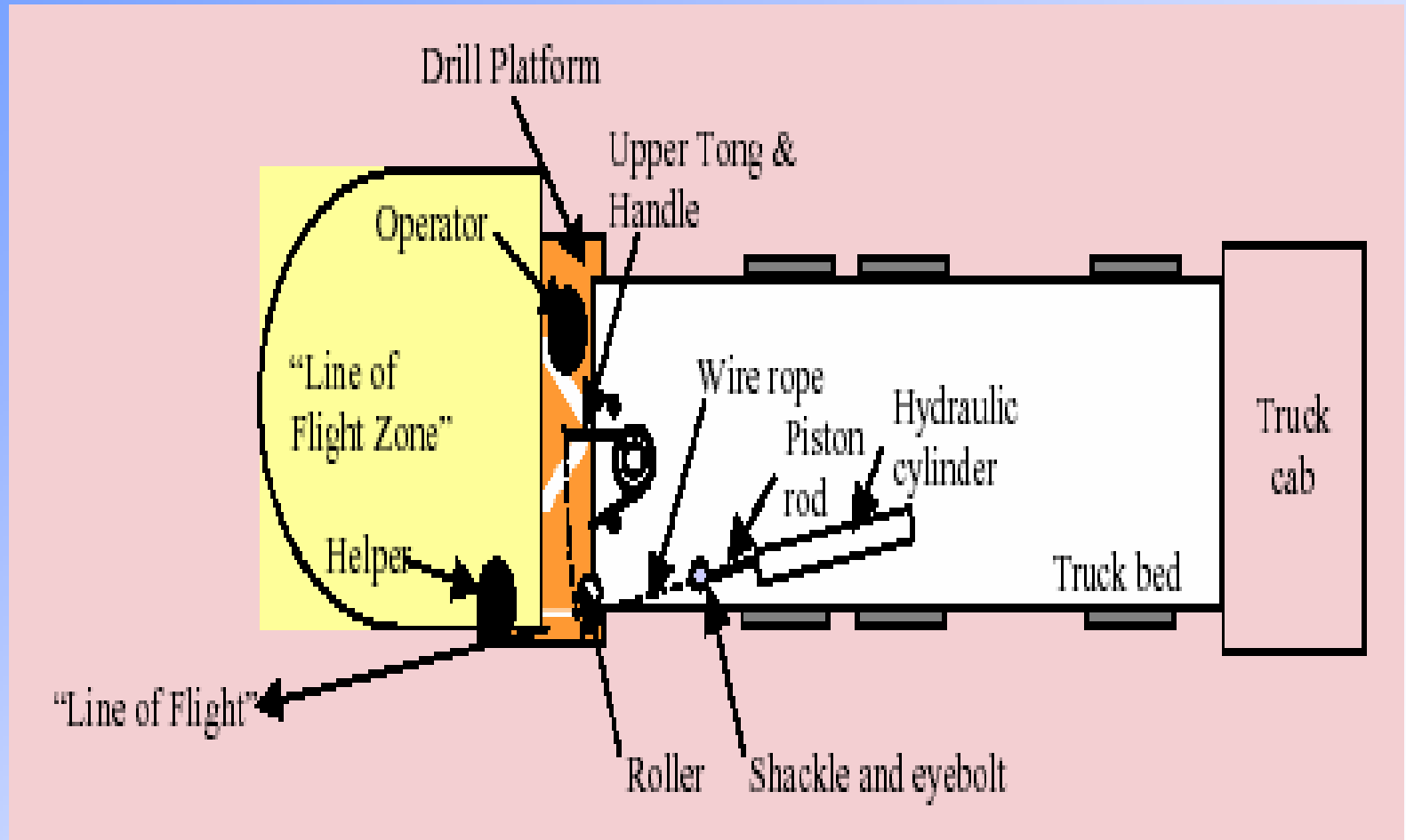
On June 21, 2001, at approximately 9:40 A.M., a construction sub-tier contractor employee (the "Operator") at the Fermi National Accelerator Laboratory (Fermilab) received serious head injuries requiring hospitalization when he was struck by part of the drilling rig (a "tong") that he was operating. The equipment involved in the accident, known as a tong, was a 32-inch steel bar with a handle essentially used as a pipe wrench to connect and disconnect drill pipe. The accident occurred when a welded connection in the hydraulic system used to apply force to the tong failed, as the two-man crew was removing lower sections of the drill assembly. The drill rig Helper indicated that, at the time of weld failure, the Operator was standing with his head near the tong and operating the hydraulic cylinder to disconnect a drill section joint. Based on an analysis of the evidence, the Board concluded that the weld failure released tension on a wire rope sling attached to the tong; the tong recoiled toward the Operator and struck him in the head. Failure of the weld was determined to be the direct cause of the accident. The Operator remained hospitalized until July 9, 2001.

# Why a Type A Investigation???

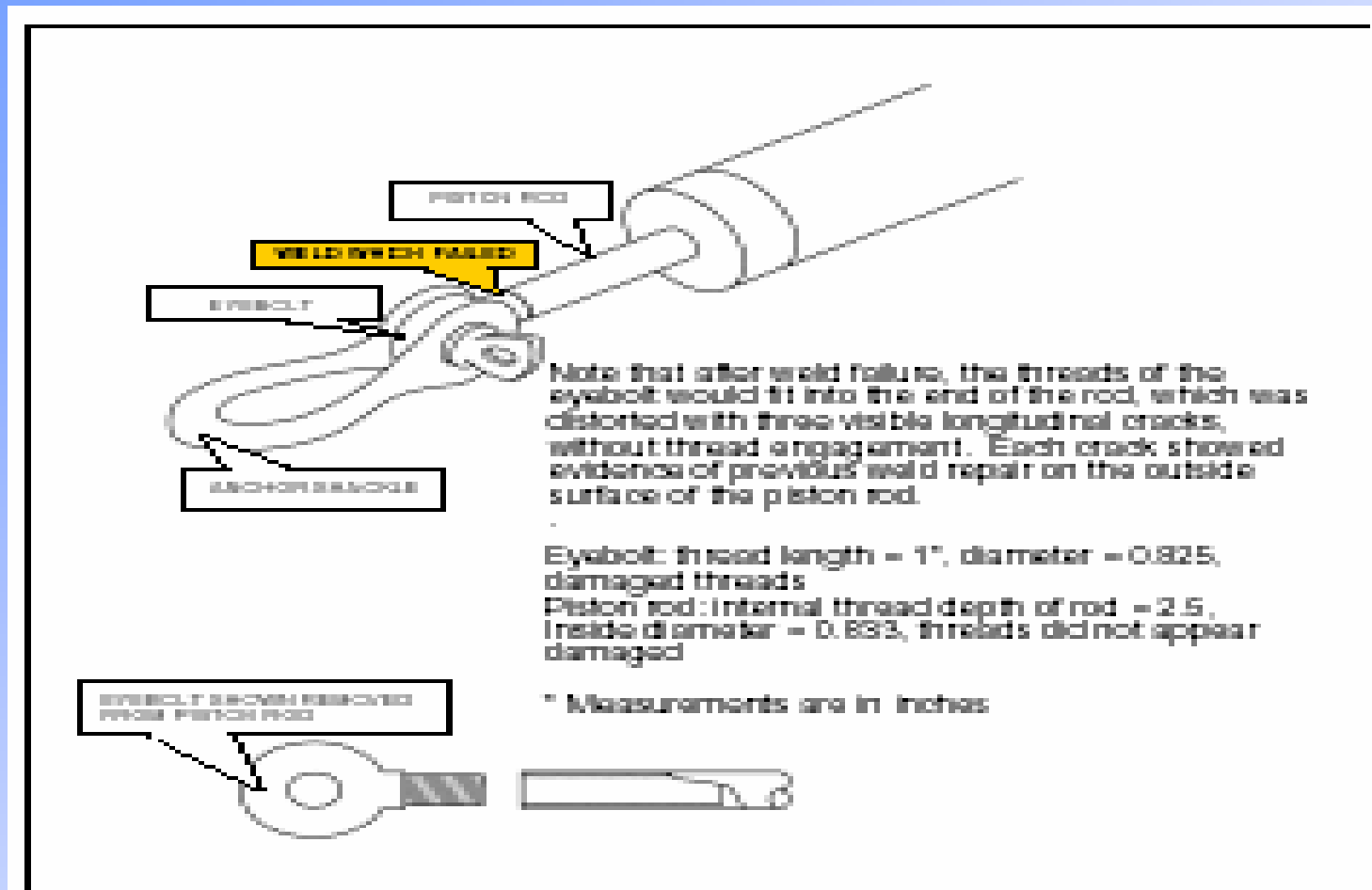
---

- Equipment failure (field repaired)
- Personnel Injury (20 days hospitalized)
- Past history

# Segregate Personnel and Equipment



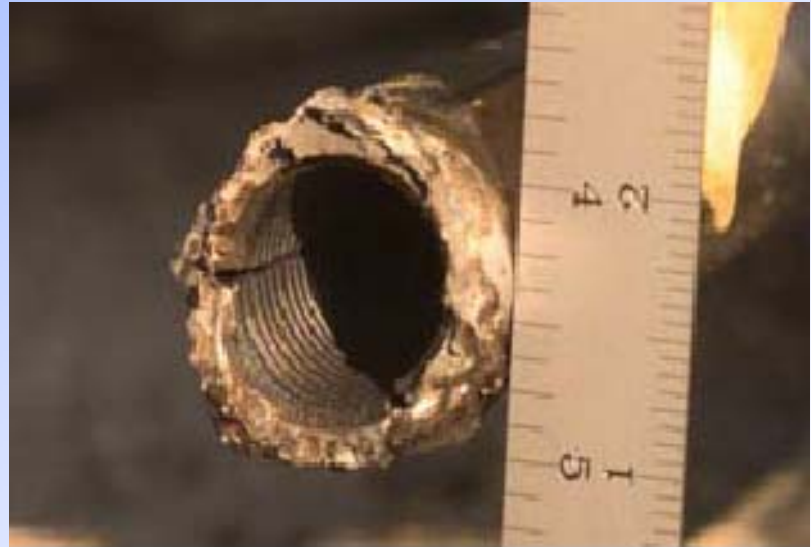
# Piston Rod/Eye Bolt Assembly



**Figure 2-1. Piston Rod End Fixture**

# Failed Eyebolt

---



# History

---

- 1997: Type B – Electrical Arc Blast
- 1998: Type B – Flammables Fire/Explosion
- 1999: ----- Saw cut electrical conduits
- 2001: ----- Rock fall injury in target hall
- 2001: ----- 2<sup>nd</sup> degree chemical burn
- 2001: ----- Worker injured move Xformer
- 2001: ----- Broken ribs, rigging incident

**Table 3-1. Examples of Safety Deficiencies at the Drilling Site**

<b>Equipment</b>	<b>Deficiency</b>
Compressor Trailer	<ul style="list-style-type: none"> <li>• Bald tires</li> <li>• Gouged tires</li> <li>• Bent wheel rim</li> <li>• No barricades/fall protection on work platforms</li> <li>• Leaking fuel/oil</li> </ul>
Mist Pump	<ul style="list-style-type: none"> <li>• Inadequate guarding on rotating equipment</li> </ul>
Portable Generator	<ul style="list-style-type: none"> <li>• Rotating equipment not guarded</li> <li>• Leaking oil</li> <li>• Makeshift lifting attachment – no load rating</li> </ul>
Wire Rope Slings	<ul style="list-style-type: none"> <li>• Inadequate Storage</li> <li>• Compressed eyes</li> <li>• Birdcaging</li> <li>• Kinks</li> <li>• Crushing</li> <li>• Abrasions</li> <li>• Broken cores</li> <li>• Shortened/attached to hook by knotting</li> <li>• No regular inspections</li> <li>• No rated capacity – damaged slings not removed from service</li> </ul>
Synthetic Web Slings	<ul style="list-style-type: none"> <li>• Markings and codings illegible</li> <li>• Discoloration</li> <li>• Distortion</li> <li>• Cuts</li> <li>• Abrasions</li> <li>• Damaged slings not removed from service</li> <li>• No regular inspections</li> </ul>
Welded Alloy Steel Chains	<ul style="list-style-type: none"> <li>• Missing permanently affixed, durable identification of size, grade, rated capacity and sling manufacturer</li> <li>• Deformed links</li> </ul>
Inadequate Electrical Installations	<ul style="list-style-type: none"> <li>• Electrical extension cords not designed for construction applications (hard or extra hard usage)</li> <li>• Electrical extension cords not protected from damage (damaged extension cords on the ground)</li> <li>• Ground fault circuit interrupters not used</li> <li>• Makeshift light string – leads inadequately terminated</li> <li>• Insulation worn off power cord for submersible sump pump</li> <li>• Extension cord not protected from damage when run through trailer door pinch point</li> </ul>
Inadequate Fall Protection	<ul style="list-style-type: none"> <li>• Fall protection not used when climbing or working at or above six feet</li> <li>• Fall protection equipment (harness) not fit for use</li> <li>• Work surfaces at or above six feet not guarded</li> </ul>
Inadequate Walking/working Surfaces	<ul style="list-style-type: none"> <li>• Wooden pallets used for walking surfaces present tripping hazard</li> <li>• Slipping hazards due to oil or other fluids on rig/equipment deck</li> </ul>

# Causal Factors

---

- Contributing Causes –
  - LTA ES&H lessons learned
  - LTA ISM flow-down enforcement
  - LTA communication (R2A2s & controls)
  - LTA cont. ES&H training

# Causal Analysis (cont)

---

- Direct Cause – Equipment Failure (weld)
- Root Cause – Mgmt failure to implement HA process (task specific hazards)

# Judgment of Needs

---

Three full pages defining needs

# Integrated Safety Mgmt

---

- **Define the Scope of Work**
  - Work package (job letter)  
Communication & ISM flowdown sub-contractors  
Contract administration  
Roles and responsibilities defined
- **Analyze Hazards**
  - Hazard analysis
- **Develop and Implement Controls**
  - Maintenance  
Inspection of equipment  
Testing of weld repair  
Accepted industry practices  
Training

# Integrated Safety Mgmt (2)

---

- **Perform Work Within Controls**
  - Procedure use and adherence
  - Work readiness and equipment condition
- **Feedback and Improvement**
  - Corrective action processes
  - Lessons learned
  - Performance feedback processes
- **Physical System Barriers**
  - Human-machine interface
  - Limit on tong movement
  - Connection of eyebolt to piston

# Resources

---

- <http://tis.eh.doe.gov/oversight/reports/accidents/typea/0108fermi/0108fermi.html>
- <http://tis.eh.doe.gov/oesummary>
- <https://sbms.bnl.gov/lessons/II00t011.htm>

# Conclusion

---

- Accident was preventable
- Chain of ES&H control of failures
- Past history
- LTA flow-down of ES&H/ISM expectations
- Can that happen here?
- In doubt ... CALL in SME
- Learn by others mistakes (LL & OE)